



Persistent polar depletion of stratospheric ozone and emergent mechanisms of ultraviolet radiation-mediated health dysregulation

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Abstract:

Year 2011 noted the first definable ozone "hole" in the Arctic region, serving as an indicator to the continued threat of dangerous ultraviolet radiation (UVR) exposure caused by the deterioration of stratospheric ozone in the northern hemisphere. Despite mandates of the Montreal Protocol to phase out the production of ozone-depleting chemicals (ODCs), the relative stability of ODCs validates popular notions of persistent stratospheric ozone for several decades. Moreover, increased UVR exposure through stratospheric ozone depletion is occurring within a larger context of physiologic stress and climate change across the biosphere. In this review, we provide commentaries on stratospheric ozone depletion with relative comparisons between the well-known Antarctic ozone hole and the newly defined ozone hole in the Arctic. Compared with the Antarctic region, the increased UVR exposure in the Northern Hemisphere poses a threat to denser human populations across North America, Europe, and Asia. In this context, we discuss emerging targets of UVR exposure that can potentially offset normal biologic rhythms in terms of taxonomically conserved photoperiod-dependent seasonal signaling and entrainment of circadian clocks. Consequences of seasonal shifts during critical life history stages can alter fitness and condition, whereas circadian disruption is increasingly becoming associated as a causal link to increased carcinogenesis. We further review the significance of genomic alterations via UVR-induced modulations of phase I and II transcription factors located in skin cells, the aryl hydrocarbon receptor (AhR), and the nuclear factor (erythroid-derived 2)-related factor 2 (Nrf2), with emphasis on mechanism that can lead to metabolic shifts and cancer. Although concern for adverse health consequences due to increased UVR exposure are longstanding, recent advances in biochemical research suggest that AhR and Nrf2 transcriptional regulators are likely targets for UVR-mediated dysregulations of rhythmicity and homeostasis among animals, including humans.

Source: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3768272>

Resource Description

Exposure : ☒

weather or climate related pathway by which climate change affects health

Air Pollution, Solar Radiation, Temperature, Unspecified Exposure

Air Pollution: Ozone

Temperature: Fluctuations

Climate Change and Human Health Literature Portal

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Impact:

specification of health effect or disease related to climate change exposure

Cancer

Resource Type:

format or standard characteristic of resource

Review

Timescale:

time period studied

Time Scale Unspecified